What is claimed:

1. A 2-way terminus device, based on adaptive filtering, for connecting both a signal source and a signal receiver to an end of a cable or wire channel for simultaneous transmission and reception of data signals in the same frequency band in said cable or wire channel, comprising:

(a) a signal source and a first isolation amplifier, and an adaptive filter whose input is connected to said signal source through said first isolation amplifier,

(b) a difference amplifier, and a connection between the output of said adaptive filter and the negative input of said difference amplifier,

(c) a connection between said cable or wire channel and the positive input of said difference amplifier, connected to an output terminal to provide a connection to said signal receiver, the output of said difference amplifier, being the received signal,

(d) a connection between the output of said difference amplifier and the error signal input of said adaptive filter,

(e) a connection between the output of said first isolation amplifier and a small signal delay unit Δ whose output provides an input to a second isolation amplifier, said second isolation amplifier having the capability for signal amplification while driving a low impedance load, said delay unit having delay ranging from zero to the time duration of the impulse response of said adaptive filter,

(f) a connection between the output of said second isolation amplifier and a first terminal of an impedance whose impedance value is equal to the characteristic impedance of said cable or wire channel,

(g) a connection between the second terminal of said impedance and the said cable or wire channel, thus providing a two-way signal connection between said 2-way terminus device and said cable or wire channel, and

(h) an adaptive algorithm stored in and implemented by said adaptive filter for the purpose of minimization of the mean square of said error.

2. The 2-way terminus device of claim 1, wherein said input signal is digital, said output signal is digital, and the said output of said second isolation amplifier is digital, and said adaptive filter is implemented in digital form, having a digital input signal, a digital error signal, a digital output signal, and having a sampling frequency or cycle frequency synchronized to that of the said input signal, the said output signal, and the said output of said second isolation amplifier.

3. The 2-way terminus device of claim 1, wherein said adaptive filter has:

(a) an analog-to-digital converter to convert the analog input signal to a digital input signal,

(b) an analog-to-digital converter to convert the analog error signal to a digital error signal,

(c) a digital adaptive filter connected and configured so that its input signal is the said digital input signal, its error signal is the said digital error signal, and its output is a digital output signal, and

(d) a digital-to-analog converter to convert said digital output signal to analog form to provide an analog output signal for the said adaptive filter.

4. A two-way communication system , based on adaptive filtering, for simultaneous transmission and reception of information signals through a channel of coaxial cable or twisted pair cable comprising:

(a) a first source of data signals, a first data receiver, and a first 2-way terminus device connected by means of its 2 -way terminal to the first end of said channel, connected by means of its input terminal to said first source of data signals, and connected by means of its output terminal to said first data receiver, and

(b) a second source of data signals, a second data receiver, and a second 2-way terminus device connected by means of its 2-way terminal to the second end of said channel, connected by means of its input terminal to said second source of data signals, and connected by means of its output terminal to said second data receiver, so that signals can be sent from the first source of data signals to the second receiver and from the second source of data signals to the first receiver without interference.

5. A 2-way repeater amplifier device, based on adaptive filtering, comprising:

(a) a first cable or channel and a second cable or channel.

(b) a first 2-way terminus device and a second 2-way terminus device,

(c) a connection connecting the one end of the first cable or channel to the 2-way terminal of said first 2-way terminus device, and a connection connecting one end of the second cable or channel to the 2-way terminal of said second 2-way terminus device, and

(d) a crisscross connection between said first and second 2-way terminus devices, said crisscross connection connecting the output terminal of said first 2-way terminus device to the input terminal of said second 2-way terminus device, and connecting the output terminal of said second 2-way terminus device to the input terminal of said first 2-way terminus device.

6. A two-way communication system , based on adaptive filtering, for simultaneous transmission and reception of information signals through a channel of coaxial cable or twisted pair cable requiring repeater amplification comprising:

(a) a first 2-way terminus device having an input terminal connected to input signal source A, an output terminal for outputting an amplified signal B, and a 2-way terminal connected to the first end of a first coaxial cable or twisted pair channel,

(b) a 2-way repeater amplifier device whose first 2-way terminal is connected to the second end of said first channel and whose second 2-way terminal is connected to the first end of a second coaxial cable or twisted pair channel, and

(c) a second 2-way terminus device whose 2-way terminal is connected to the second end of said second coaxial cable or twisted pair channel, whose input terminal is connected to input signal source B, and whose output terminal outputs an amplified signal A.

7. The two-way communication system of claim 6, wherein said coaxial cable or twisted pair channel incorporates two or more 2-way repeater amplifier devices for two way signal transmission over long distances.

8. The 2-way repeater amplifier device of claim 5 wherein said 2-way terminus devices connected with a crisscross connection have digitally-implemented adaptive filters and have at least one sample time or one unit of delay along the closed-loop path which includes said crisscross connection, said digitally-implemented adaptive filters, and two difference amplifiers or signal subtractors.

9. A two way-wireless communication system for simultaneous transmission and reception of information signals in the same frequency band or in overlapping frequency bands comprising:

(a) a radio transmitter, a radio receiver, and an antenna,

(b) a coupling means such as a transformer, a directional coupler, or some other electric network for connecting said transmitter and said receiver to said antenna,

(c) an RF modulator and a source of baseband signal to be transmitted, said baseband signal provided as the input to said RF modulator,

(d) an RF power amplifier and a delay device for connecting the output of said RF modulator to said RF power amplifier serving as the transmitter, the delay time of said delay device being small, ranging from zero to the impulse response duration of said RF amplifier,

(e) a connection between the output of said RF amplifier and said coupling means to couple the transmitter to said antenna,

(f) a subtractive means, and a connection between said coupling means and the positive input of said subtractive means,

(g) an adaptive filter,

(h) a connection between the output of said RF modulator and the input of said adaptive filter,

(i) a radio receiver, and a connection between the output of said adaptive filter and the negative input of said subtractive means, the output of said subtractive means connected to the input of said radio receiver,

(j) a connection between the output of said subtractive means and the error input of said adaptive filter to provide an error signal for adapting said adaptive filter,

(k) an adaptive algorithm or mathematical procedure implemented by said adaptive filter for adjusting its parameters for minimization of the mean square of said error signal, and

(l) an output terminal of the radio receiver for outputting a received baseband signal.

10. A 2-way terminus device, incorporating a directional coupler and based on adaptive filtering, for connecting both a signal source and a signal receiver to an end of cable or wire channel for simultaneous transmission and reception of data signals in the same frequency band or in overlapping bands comprising:

(a) a first isolation amplifier, and an adaptive filter whose input is connected to said signal source through said first isolation amplifier,

(b) a difference amplifier, and a connection between the output of said adaptive filter and the negative input of said difference amplifier,

(c) a delay device, and a connection between the adaptive filter input and the input of a delay device, said delay device implementing a small signal delay whose duration could range from zero to the impulse response duration of said difference amplifier,

(d) a connection between the output of said delay device and the input of said second isolation amplifier,

(e) a first impedance device, and a connection between the output of said second isolation amplifier and the first terminal of said first impedance device whose impedance is equal to the characteristic impedance of said cable or wire channel, and a connection between the second terminal of said first impedance device and the input terminal of said directional coupler,

(f) a connection between the output terminal of said directional coupler and the positive input of said difference amplifier,

(g) a second impedance device, and a second impedance device, and a connection between the output terminal of said directional coupler and the first terminal of said second impedance device whose impedance is equal to the characteristic impedance of said cable or wire channel, and a connection between the second terminal of said second impedance device and ground,

(h) a connection between the 2-way terminal of said directional coupler and said cable or wire channel,

(i) a received output signal, and a connection between the output of said difference amplifier and a terminal for outputting said received output signal,

(j) a connection between the output of said difference amplifier and the error input terminal of said adaptive filter for providing an error signal for the adaptive filter, and

(k) an adaptive algorithm or mathematical procedure implemented by said adaptive filter for adjusting its parameters for minimization of the mean square of said error signal.

11. A two-way signal or information transmission system, based on adaptive filtering and capable of transmission and reception of DSL (Digital Subscriber Line) signals and simultaneously capable of providing conventional telephone service over a conventional twisted-pair telephone line, configured to utilize

DSL signal standards and DSL hardware such as DSLAM (DSL access multiplexer) and DSL modems, comprised of:

(a) a telephone central office,

(b) a high-speed download-data stream, a low-speed download-data stream, a high speed upload-data stream, and a low-speed upload-data stream, and a two-way internet connection located at said telephone central office, capable of downloading from the internet said high-speed download-data stream and said low-speed download-data stream, and capable of uploading to the internet said high-speed upload-data stream and said low-speed upload-data stream,

(c) a first DSLAM located at said telephone central office whose input is connected to said Internet connection to receive said high-speed download-data stream, and whose output is connected to provide said low-speed upload-data stream to the Internet connection,

(d) a first DSL modem located at said telephone central office whose input is connected to said internet connection to receive said low-speed download-data stream, and whose output is connected to provide said high-speed upload-data stream to said internet connection,

(e) a first, second, and a third 2-way terminus device, a first signal summer device, a first POTS ("plain old telephone service) splitter capable of passing through high-frequency DSL signals while separating out low-frequency telephone signals, and a telephone exchange switch, all located at said telephone central office,

(f) a connection between the 2-way terminal of said first DSLAM and the 2-way terminal of said first 2-way terminus device, and a connection between the 2-way terminal of said first DSL modem and the 2-way terminal of said second 2-way terminus device,

(g) a connection between the output terminal of said first terminus device and a first input of said first summer device, a connection between the output terminal of said second terminus device and a second input of said first summer device, a connection between the output of said summer device and the input terminal of said third 2-way terminus device, and a connection between the output terminal of said third way 2-way terminus device and the input terminals of both said first and second 2-way terminus devices,

(h) a connection between the 2-way terminal of said third 2-way terminus device and a first wideband terminal of said first POTS splitter, and a connection

between the narrowband terminal of said first POTS splitter and the telephone exchange switch,

(i) a subscriber location, and said twisted pair telephone line strung between the telephone central office and said subscriber location,

(j) a connection between said telephone line and the second wideband terminal of said first POTS splitter,

(k) a computer capable of downloading and uploading high-speed data streams, a second DSLAM, a second DSL modem, a fourth, fifth and a sixth 2-way terminus device, a second signal summer, a second POTS splitter, and a standard telephone instrument, all located at the said subscriber location,

(l) a first high-speed data stream, a first low-speed data stream, a second high-speed data stream, a second low-speed data stream, a first computer terminal connected to said computer for outputting said first high-speed data stream, a connection between said first computer terminal and the input terminal of said second DSLAM, a second computer terminal connected to said computer for outputting said first low-speed data stream, a connection between said second computer terminal and the input terminal of said second DSL modem, a third computer terminal connected to said computer for inputting said second high-speed data stream, a connection between said third computer terminal and the output terminal of said second DSL modem, a fourth computer terminal connected to said computer for inputting said second low-speed data stream, and a connection between said fourth computer terminal and the output terminal of said second DSLAM,

(m) a connection between the 2-way terminal of said second DSLAM and the 2-way terminal of said fourth 2-way terminus device, a connection between the 2-way terminal of said second DSL modem and the 2-way terminal of said fifth 2-way terminus device, a connection between the output terminal of said fourth 2-way terminus device, a connection between the output terminal of said fourth 2-way terminus device and the first input of said second signal summer, a connection between the output terminal of said fifth 2-way terminus device and the second input of said second signal summer, a connection between the output of said second summer and the input terminal of said sixth 2-way terminus device, and a connection between the output terminal of said sixth 2-way terminus device and the input terminals of both the said fourth and fifth 2-way terminus devices, and

(n) a connection between the 2-way terminal of said sixth 2-way terminus device and a first wideband terminal of said second POTS splitter, a connection between the second wideband terminal of said second POTS splitter and said telephone line, and a connection between the narrowband terminal of said second POTS splitter and said telephone instrument.

12. A signal or information transmission system providing wireless individual two-way communication paths between a central antenna array and a plurality of subscriber antenna arrays, all or most communication signals being in the same frequency band, the central array and the distant subscriber arrays all connected respectively to 2-way adaptive beamformers in order to create nulls in their directivity patterns in the directions of all sources of interference, said antenna arrays not transmitting to or receiving from said directions, said information transmission system comprised of:

(a) a central antenna array, a plurality of 2-way adaptive beamformers, at least one individual 2-way adaptive beamformer for each distant subscriber, each of said adaptive beamformers transmitting and receiving through connections with the antenna elements of said central antenna array, each of said 2-way adaptive beamformers comprising,

(1) a plurality of adaptive beamformers, whose number is equal to the number of antenna elements of said central antenna array,

(2) coupling devices connecting to each of said elements to the inputs of each of said adaptive filters, a summing device whose inputs are connected to the output of said adaptive filters, a first subtractive device whose positive input is the summed signal of said summing device, a radio receiver whose input signal is the output signal of said subtractive device, the output of said radio receiver being the received baseband signal, a baseband signal to be transmitted which is inputted to an RF modulator, the output of said RF modulator providing inputs to a plurality of controlled filters that correspond one for one to the said adaptive filters, the architecture and weight values of the controlled filters set to correspond at each moment of time, to the corresponding weights of the adaptive filters, a subtracting adaptive filter whose input signal is the output signal of the said RF modulator, whose output signal is inputted to the negative input of said first subtractive device, the

output of said first subtractive device provided as the error signal for said subtracting adaptive filter, so that it can subtract the transmitted signal from the radio receiver input, a coded pilot signal generator for generating a pilot signal used while the 2-way adaptive beamformer is trained, said pilot signal inputted to the positive input of a second subtractive device, the output of said summing device connected to the negative input of said second subtractive device, the output signal of said second subtractive device provided as an error signal during training for all of the adaptive filters of said plurality of adaptive filters, a plurality of RF amplifiers to provide RF power for wireless transmission, the input signals for said RF amplifier are the corresponding output signals from said controlled filters, and connections between the output signals from said RF amplifier and the corresponding said coupling devices provide RF driving currents for the elements of the central antenna array,

(3) subtracting adaptive filters configured for canceling all transmitted signals of the central antenna array from the inputs of all of the radio receivers, the number of transmitters and the number of receivers equal to the number of distant subscribers,

(b) a plurality of distant subscriber antenna arrays each connected and configured as part of a system for the two-way communication with the central antenna array, each said system comprised of,

(1) a subscriber's array of antenna elements located away from the central antenna array,

(2) a 2-way adaptive beamformer connected to the antenna elements of said subscriber's array,

(3) an output terminal of the 2-way beamformers for outputting the received baseband signal and an input terminal of the 2-way beamformer for inputting the baseband signal to be transmitted, and

(4) a pilot signal generator used during training of subscriber's 2-way beamformers, said pilot signal being random, of finite length, and uncorrelated with all other pilot signals used in said information transmission system.

13. The signal or information transmission system of claim 12, wherein said central antenna array contains one or more antenna elements, and wherein each

antenna array of said plurality of distant subscriber antenna arrays contains one or more antenna elements.

14. A method for two-way transmission and reception of DSL signals over conventional telephone lines using existing asymmetrical DSL signal standards and existing DSL hardware so that upload and download data rates will be equal to conventional download plus upload rates, comprising the steps of:

(a) receiving and transmitting DSL and telephone signals with a telephone line at the central office, said telephone line connecting said office to a subscriber location,

(b) separating said telephone signals from the DSL signals, by means of a POTS splitter, for connection to a telephone exchange switch,

(c) separating said receiving and transmitting DSL signals into receiving and transmitting data streams by means of a first 2-way terminus device,

(d) processing said receiving and transmitting data streams with bandpass filters or with 2-way terminus devices, applying the received signal to both a DSLAM and a DSL modem, obtaining and combining high-frequency and low-frequency transmitted signal components from the said DSLAM and DSL modem for transmission to the said telephone line through the first 2-way terminus device, inputting said high-frequency and low-frequency transmitted signal components from an internet connection to the DSLAM and the DSL modem respectively, connecting high and low frequency components of said received signal from the DSL modem and the DSLAM respectively to the internet connection,

(e) separating the DSL signals from the telephone signals at the subscriber location by means of a POTS splitter,

(f) utilizing the telephone signal by a conventional telephone instrument, and

(g) performing the same operations on the DSL signal at the subscriber location as was done at the telephone central office while substituting a computer with data transfer interfaces in place of the said Internet connection.

15. A method for providing wireless two-way signal or information transmission between a central antenna array and a plurality of subscriber antenna arrays, all of said information transmission taking place simultaneously in a single frequency band, said method comprising the steps of:

(a) connecting a plurality of 2-way subscriber's adaptive beamformers to said central antenna array, the number of individuals beamformers being equal to the number of subscribers, connecting sources of input baseband signals to all of the signals input terminals of said 2-way adaptive beamformers, deriving the respective baseband output signals from the output terminals of said 2-way adaptive beamformers, providing mutually uncorrelated random pilot signals to be used by the 2-way adaptive beamformers during training,

(b) connecting a 2-way adaptive beamformer to each of the distant subscriber antenna arrays, connecting a source of input baseband signals to the input terminal of each subscriber's 2-way adaptive beamformer, deriving baseband output signals from the output terminal of each subscriber's 2-way adaptive beamformer, providing random pilot signals to be used during training times for training the said subscriber's 2-way adaptive beamformers, said pilot signals being mutually uncorrelated and uncorrelated with the pilot signals used by all the beamformers connected to the central antenna array, and

(c) providing adaptive canceling filter means for subtracting all transmitted signals from the radio receiver inputs of the 2-way adaptive beamformers connected to the central antenna array.

16. The method for providing wireless two-way signal or information transmission of claim 15, wherein the step of connecting a plurality of 2-way adaptive beamformers to said central antenna array comprises connecting said beamformers to an array of one or more antenna elements, and wherein the step of connecting a 2-way adaptive beamformer to each of the distant subscriber antenna arrays comprises connecting said beamformers to an array of one or more antenna elements.